North Carolina Department of Transportation
Planning and Environmental Branch
Statewide Planning Group
Thoroughfare Planning Unit

Clayton
1990 Thoroughfare Plan

1990 THOROUGHFARE PLAN
FOR THE
TOWN OF CLAYTON

Prepared By:

The Statewide Planning Group
of the Planning and Environmental Branch
of the Division of Highways
of the North Carolina Department of Transportation

In Cooperation With:

The Town of Clayton

The Federal Highway Administration
of the United States Department of Transportation

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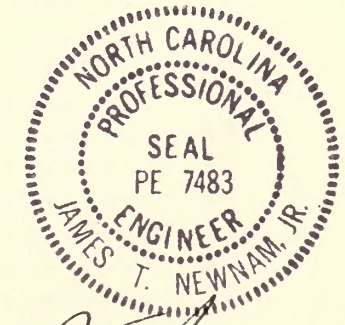
September, 1990



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3-28-91

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I. INTRODUCTION

The Town of Clayton is located in Johnston County, approximately 15 miles east of Raleigh, North Carolina (Figure 1). The heart of Clayton lies to the North of US 70, which currently carries a sizeable amount of traffic between neighboring Raleigh and the coast of North Carolina. In 1982, a comprehensive thoroughfare plan was mutually adopted by the Town of Clayton and the North Carolina Department of Transportation. Clayton has since experienced considerable growth, partly due to its convenient proximity to the Capital City. Increases in industrial, commercial, and residential development are expected to continue as Clayton successfully cultivates its small town flavor with a progressive approach toward economic vitality. Town leaders recognize that as Clayton attracts further development, the demand for an efficient road system will become increasingly apparent. In a cooperative effort with the Town of Clayton, the North Carolina Department of Transportation conducted a reevaluation of the Clayton Thoroughfare Plan to develop a plan that will meet the changing travel demands expected in the Clayton area.

There are many and varied benefits to be derived from thoroughfare planning, but the primary objective is to enable the urban street system to be progressively developed in a manner that will adequately service future traffic demands. In addition, the thoroughfare plan should embody the details of accepted thoroughfare planning principles. Thoroughfares were located based on field investigation, aerial photos, existing and anticipated land uses, topographic conditions, and the travel concerns of the community and its public representatives.

Some of the major benefits to be derived from thoroughfare planning are:

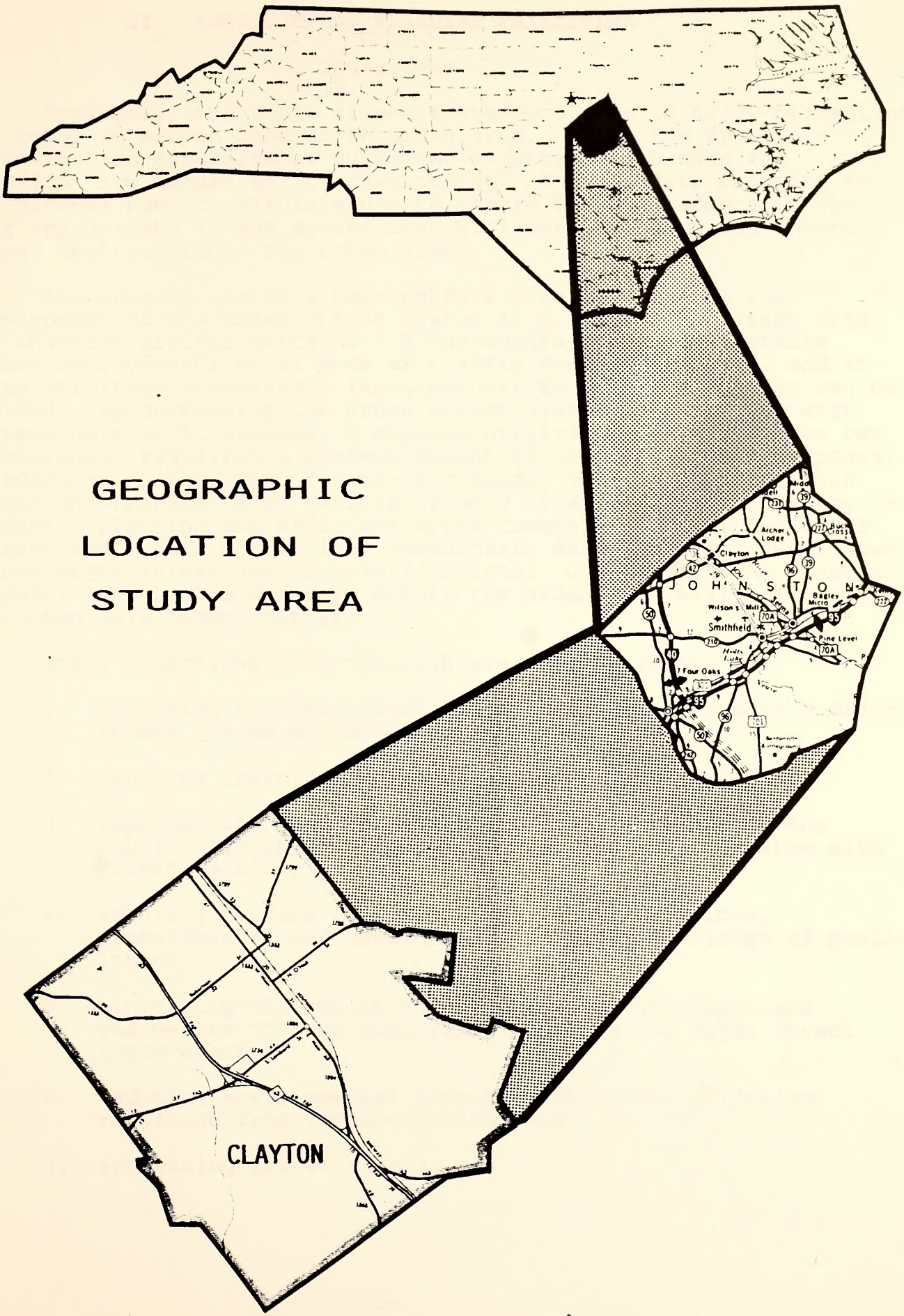
(a) A minimum amount of land will be required for street and highway purposes.

(b) Local citizens will know which streets will be developed as major thoroughfares and thus will have assurance that their residential street will not one day become a major traffic carrier.

(c) Land developers will be able to design their subdivisions so that subdivision streets will function in a non-conflicting manner with the overall plan.

It should be emphasized that the recommended plan is based on anticipated growth of the urban area as indicated by current trends. Prior to construction of specific projects, a more detailed study will be required to reconsider development trends and to determine specific locations and design requirements.

FIGURE 1


GEOGRAPHIC
LOCATION OF
STUDY AREA
JOHNSTON
Clayton
Smithfield
Four Oaks
Pine Level
CLAYTON

II. THOROUGHFARE PLANNING PRINCIPLES

Objectives

Typically, the urban street system occupies 25 to 30 percent of the total developed land in an urban area. Since the system is permanent and expensive to build and maintain, much care and foresight are needed in its development. Thoroughfare planning is the process public officials use to assure the development of the most appropriate street system that will meet existing and future travel desires within the urban area.

The primary aim of a thoroughfare plan is to guide the development of the urban street system in a manner consistent with the changing traffic patterns. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and it helps eliminate unnecessary improvements, so needless expense can be avoided. By developing the urban street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained, requiring a minimum amount of land for street purposes. In addition to providing for traffic needs, the thoroughfare plan should incorporate those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population, commercial, and industrial development affect major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

1. providing for the orderly development of an adequate major street system as land development occurs,

2. reducing travel and transportation costs,

3. reducing the cost of major street improvements to the public through the coordination of the street system with private action,

4. enabling private interests to plan their actions, improvements, and development with full knowledge of public intent,

5. minimizing disruption and displacement of people and businesses through long range planning for major street improvements,

6. reducing environmental impact, such as air pollution, resulting from transportation, and

7. increasing travel safety.

Thoroughfare planning objectives are achieved through both improving the operational efficiency of thoroughfares, and improving the system efficiency through system coordination and layout.

Operational Efficiency

A street's operational efficiency is improved by increasing the capability of the street to carry more vehicular traffic and people. In terms of vehicular traffic, a street's capacity is defined by the maximum number of vehicles that can pass a given point on a roadway during a given period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity include street widening, intersection improvements, improving vertical and horizontal alignment, and eliminating roadside obstacles. For example, widening of a street from two to four lanes more than doubles the capacity of the street by providing additional maneuverability for traffic. This reduces the impedances to traffic flow caused by slow moving or turning vehicles and the adverse effects of horizontal and vertical alignments.

Operational ways to improve street capacity include:

1. Control of access -- A roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number.

2. Parking removal -- Removal of parking along a roadway will increase capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking and unparking vehicles.

3. One-way operation -- The capacity of a street can sometimes be increased by 20-50%, depending upon turning movements and overall street width, by initiating one-way traffic operation. One-way streets also can improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.

4. Reversible lanes -- Reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods.

5. Signal phasing and coordination -- Uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

Altering travel demand is another way to improve the operational efficiency of existing streets. Travel demand can be reduced or altered in the following ways:

1. Encourage people to form carpools and vanpools for journeys to work and other trip purposes. This reduces the number of vehicles on the roadway and raises the people carrying capability of the street system.

2. Encourage the use of transit and bicycle modes.

3. Encourage industries, businesses, and institutions to stagger work hours or establish variable work hours for employees. This will spread peak travel over a longer period and thus reduce peak hour demand.

4. Plan and encourage land use development or redevelopment in a more travel efficient manner.

System Efficiency

Another means for altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost to the user. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Functional Classification

Streets perform two primary functions -- traffic service and land service, which when combined, are basically incompatible. The conflict is not serious if both traffic and land service demands are low. However, when traffic volumes are high, conflicts created by uncontrolled and intensely used abutting property leads to intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is to provide a functional system of streets, roads, and highways that permit direct, efficient, and safe travel. Different elements in the system are designed to have specific functions and levels of service, thus minimizing the traffic and land service conflict. Streets are categorized as to function as local access streets, minor thoroughfares, or major thoroughfares.

Local Access Streets provide access to abutting property. They are not intended to carry heavy volumes of traffic and should be located such that only traffic with origins and destinations of the streets would be served. Local streets may be further classified as either residential, commercial, and/or industrial depending upon the type of land use they serve.

Minor Thoroughfares are more important streets on the city system. They collect traffic from local access streets and carry it

to the major thoroughfares. They may in some instances supplement the major thoroughfare system by facilitating minor through traffic movements. A third function that may be performed is that of providing access to abutting property. They should be designed to serve limited areas so that their development as major thoroughfares will be prevented.

Major Thoroughfares are the primary traffic arteries of the city. Their function is to move intracity and intercity traffic. The streets that comprise the major thoroughfare system also may serve abutting property, however, their principal function is to carry traffic. They should not be bordered by uncontrolled strip development because such development significantly lowers the capacity of the thoroughfare to carry traffic and each driveway is a danger and an impediment to traffic flow. Major thoroughfares may range from a two-lane street carrying minor traffic volumes to major expressways with four or more traffic lanes. Parking normally should not be permitted on major thoroughfares.

Idealized Major Thoroughfare System

A coordinated system of major thoroughfares forms the basic framework of the urban street system. A major thoroughfare system that is most adaptable to desire lines of travel within an urban area is the radial-loop system. It permits direct movement between various areas of the city. This system consists of several functional elements--radial streets, crosstown streets, loop system streets, and bypasses (Figure 2).

Radial streets provide for traffic movement between points located on the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

If all radial streets crossed in the central area, an intolerable congestion problem would result. To avoid this problem, it is very important to have a system of crosstown streets that form a loop around the central business district. This system allows traffic moving from origins on one side of the central area to destinations on the other side to follow the area's border. It also allows central area traffic to circle and then enter the area near a given destination. The effect of a good crosstown system is to free the central area of crosstown traffic, thus permitting the central area to function more adequately in its role as a business or pedestrian shopping area.

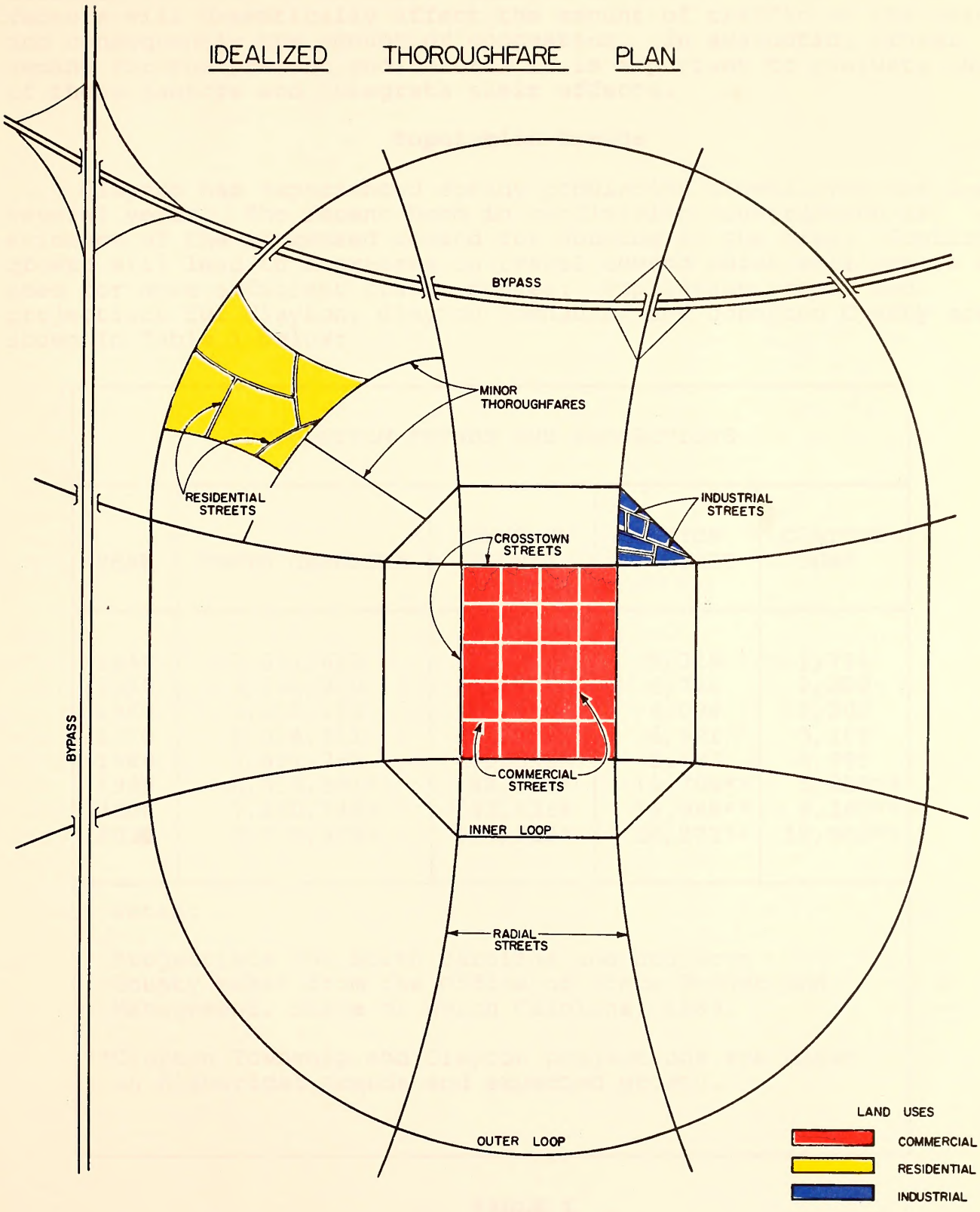
Loop system streets move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets do not necessarily carry heavy volumes of traffic, but they function to help relieve central areas. There may be one or more loops, depending on

the size of the urban area. They are generally spaced one-half mile to one mile apart, depending on the intensity of land use.

A bypass is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing traffic that has no desire to be in the city. Bypasses are usually designed to through-highway standards, with control of access. Occasionally, a bypass with low traffic volume can be designed to function as a portion of an urban loop. The general effect of bypasses is to expedite the movement of through traffic and to improve traffic conditions within the city. Bypasses tend to increase the economic vitality of the local area by removing through traffic and allowing the streets to be used for shopping and home-to-work traffic.

The concepts presented in the discussion of operational efficiency, functional classification, and idealized major thoroughfare system are the conceptual tools available to the transportation planner in developing a thoroughfare plan. In actual practice, a thoroughfare plan is developed for established patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these constraints and the many other factors that affect major street locations.

FIGURE 2


IDEALIZED THOROUGHFARE PLAN
BYPASS
MINOR THOROUGHFARES
RESIDENTIAL STREETS
INDUSTRIAL STREETS
CROSSTOWN STREETS
BYPASS
COMMERCIAL STREETS
INNER LOOP
RADIAL STREETS
OUTER LOOP
LAND USES
COMMERCIAL
RESIDENTIAL
INDUSTRIAL

III. EXISTING AND PROJECTED CONDITIONS

Travel is directly related to population, employment, and the economic vitality of an area. Changes in one or more of these factors will dramatically affect the amount of traffic on the road and consequently the amount of congestion. In evaluating travel demand for the present and future, it is important to evaluate each of these factors and integrate their effects.

Population Trends

Clayton has experienced steady population growth over the past several years. The recent boom in subdivision construction is evidence of the increased demand for housing in the area. Continued growth will lead to increases in travel demand which will create a need for more efficient travel routes. Population trends and projections for Clayton, Clayton Township, and Johnston County are shown in Table 1 below:

POPULATION TRENDS AND PROJECTIONS

YEAR	NORTH CAROLINA	JOHNSTON COUNTY	CLAYTON TOWNSHIP	CLAYTON TOWN
1940	3,571,623	63,798	5,329	1,711
1950	4,061,929	65,906	5,726	2,229
1960	4,556,155	62,936	6,094	3,302
1970	5,084,411	61,737	6,671	3,103
1980	5,881,766	70,599	8,423	4,091
1990	6,613,391*	82,509*	11,709**	5,855**
2000	7,260,748*	93,431*	14,989**	8,382**
2010	7,775,979*	103,063*	18,272**	12,000**

Notes:

* Projections for North Carolina and Johnston County taken from the Office of State Budget and Management, State of North Carolina, 1989.

**Clayton Township and Clayton projections are based on historical trends and expected growth.

TABLE 1

Travel Demand

Travel demand is generally reported in the form of average dail traffic counts. Traffic counts are taken regularly at several locations in and around Clayton by the North Carolina Department of Transportation. To estimate future travel demand, traffic trends over the past nineteen years were studied. A comparison of annual growth rates from 1970 to 1989 at various count locations in Clayton shows average annual growth rates ranging from 3.5% to 9.8%.

During the last four years, Clayton has experienced a rapid increase in travel demand. It is hard to predict future travel base on growth spurts like the one Clayton is presently experiencing. Most areas find it difficult to sustain high annual growth rates for long periods of time. However, construction of the proposed US 70 Bypass is expected to produce another travel peak within the next 20 years.

Influence of US 70 Bypass

Situated in a strategic location between Raleigh and Coastal North Carolina, Clayton processes traffic of varying types. Vacationers, commuters and commercial vehicles make up a large portion of the traffic passing through Clayton on US 70. US 70 also handles travel generated by residents and businesses in and around Clayton. Traffic projections along US 70 indicate that there is a need for a bypass of Clayton. The bypass project is already funded in the 1990 - 1996 Transportation Improvement Program (TIP). Study of the location of the bypass was not included as part of the Thoroughfare Plan since detailed environmental assessments are already underway. Alignments both to the north and south are being considered with interchanges limited to a few locations. The thoroughfare plan will supplement any alignment of the bypass by providing a system of streets that link the proposed interchanges with the radial streets. This eliminates the inconvenience of trave to the downtown area for trips not destined to that area.

With the added convenience of the bypass, commuters will find Clayton a more attractive place to reside. Highway retail businesse and industries will also build along the bypass. All of this development will generate additional traffic which must be safely an efficiently distributed. The existing and expected average traffic volumes based on traffic growth rates varying upwards from 2.5% are shown in Figures 4 and 5.

Economy and Employment

North Carolina's active role in recruiting industry has brought many large employers into the State. Clayton hosts industries such as Cutter Biological, Champion, and KABI, all of which have provided job opportunities and economic stability for the people in and aroun Clayton. Facilities operated by North Carolina State University and Rhone Poulenc also stand out as major contributors to the economic vitality of the area. These centers specialize in agricultural

research and utilize large portions of land in their unique agricultural role. Proximity to Raleigh and the Research Triangle Park will positively influence the Clayton area as development continues.

Commercial development in Clayton is located mainly along US 70, NC 42, and Main Street. The downtown area is peppered with specialty shops owned and operated by local citizens. Highway retail businesses, typical to major highways, line the US 70 corridor. Although construction of the proposed US 70 Bypass of Clayton will remove much of the through traffic from the heart of Clayton, the area is expected to generate enough internal traffic to strengthen the existing commercial development both in the downtown area and along existing US 70. Internal traffic, generated by local travel, is expected to double to 95,000 trips per day by the year 2010.

The US 70 Bypass of Clayton is expected to have a significant affect on development trends in the area. Convenience of travel will be a key factor in attracting commuters to the Clayton area after completion of the bypass. Commercial and industrial developers will also take advantage of the exposure that a facility of this type provides. As shown in Figure 3, new commercial development is expected to migrate to the interchanges, industrial development should continue in the southeastern portion of the area, and residential development should continue to the south.

Traffic Accidents

Traffic accident analysis is a serious and important consideration in a thoroughfare plan development. The source of traffic accidents can be broken down into three general categories. The first is the physical environment including such things as road condition, weather, road obstructions, and traffic conditions. The second source is associated with the driver. This includes the driver's mental alertness, distractions in the car, ability to handle the vehicle, and reaction time. The third source is associated with the physical attributes of the vehicle itself. This would include such things as the condition of the brakes and tires, vehicle responsiveness, size of the vehicle, and how well the windshield wipers and defroster work. All traffic accidents can be attributed to one or more of these sources; however, the driver is often the primary source.

Accident data for January 1987 through December 1989 was studied as part of the development of the Thoroughfare Plan. The segment of US 70 that intersects Boling and Main Streets has a very high accident count. A reduction in the complexity of this intersection, as shown on the Thoroughfare Plan, will decrease potential traffic conflict, which should provide a safer environment for intersection maneuvers. Table 2 lists the locations where accidents frequently occur. The majority of these are rear-end type collisions.

Clayton Selected Accident Inventory (January 1987 - December 1989)	
Location	Number of Accidents
US 70 @ Robertson Street	33
US 70 @ Main Street	22
US 70 @ Boling Street	21
SR 1004 @ O'Neil Street	14
SR 1004 @ Robertson Street	12
US 70 @ Moore Street	11

Table 2

Capacity Analysis

A good indication of the adequacy of the existing major street system is a comparison of the traffic volumes with the ability of th streets to move traffic freely at a desirable speed. The ability of a street to move traffic freely, safely, and efficiently with a minimum delay is controlled principally by the spacing of major devices utilized. Thus, the ability of a street to move traffic can be increased by restricting parking and turning movements, using proper sign and signal devices, and by the application of other traffic engineering techniques.

Capacity is defined as the maximum number of vehicles that hav a reasonable expectation of passing over a given section of a roadwa in one direction, or in both directions, during a given period under prevailing roadway and traffic conditions.[1] The relationship of traffic volumes to the capacity of the roadway will determine the **level of service** being provided. Six levels of service have been selected to identify the conditions existing under various speed and volume conditions on a highway or street.

The six levels of service are illustrated in Figure 6, and the are defined on the following pages. The definitions are general and conceptual in nature, but may be applied to urban arterial levels of service. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them. Each chapter of th 1985 Highway Capacity Manual contains more detailed descriptions of the levels of service as defined for each facility type.

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[1] Highway Capacity manual, Special Report 209, 1985, p. 1-3.

1. **Level-of-service A** describes primarily free flow operations at average travel speeds, usually about 90 percent of the free flow speed for the arterial class. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Stopped delay at signalized intersections is minimal.

2. **Level-of-service B** represents reasonable unimpeded operations at average travel speeds, usually about 70 percent of the free flow speed for the arterial class. The ability to maneuver within the traffic stream is only slightly restricted and stopped delays are not bothersome. Drivers are not generally subjected to appreciable tension.

3. **Level-of-service C** represents stable operations. However, ability to maneuver and change lanes in midblock locations may be more restricted than in LOS B, and longer queues and/or adverse signal coordinations may contribute to lower average travel speeds of about 50 percent of the average free flow speed for the arterial class. Motorists will experience an appreciable tension while driving.

4. **Level-of-service D** borders on a range on which small increases in flow may cause substantial increases in approach delay and, hence, decreases in arterial speed. They may be due to adverse signal progression, inappropriate signal timing, high volumes, or some combination of these. Average travel speeds are about 40 percent of free flow speed.

5. **Level-of-service E** is characterized by significant approach delays and average travel speeds of one-third the free flow speed or lower. Such operations are caused by some combination of adverse progression, high signal density, extensive queuing at critical intersections, and inappropriate signal timing.

6. **Level-of-service F** characterizes arterial flow at extremely low speeds below one-third to one-quarter of the free flow speed. Intersection congestion is likely at critical signalized locations, with high approach delays resulting. Adverse progression is frequently a contributor to this condition.

The recommended improvements and overall design of the Thoroughfare Plan were based on achieving a minimum of LOS D on existing facilities, and LOS C on new facilities. LOS D is considered the "**practical capacity**" of a facility, or that at which the public begins to express dissatisfaction.

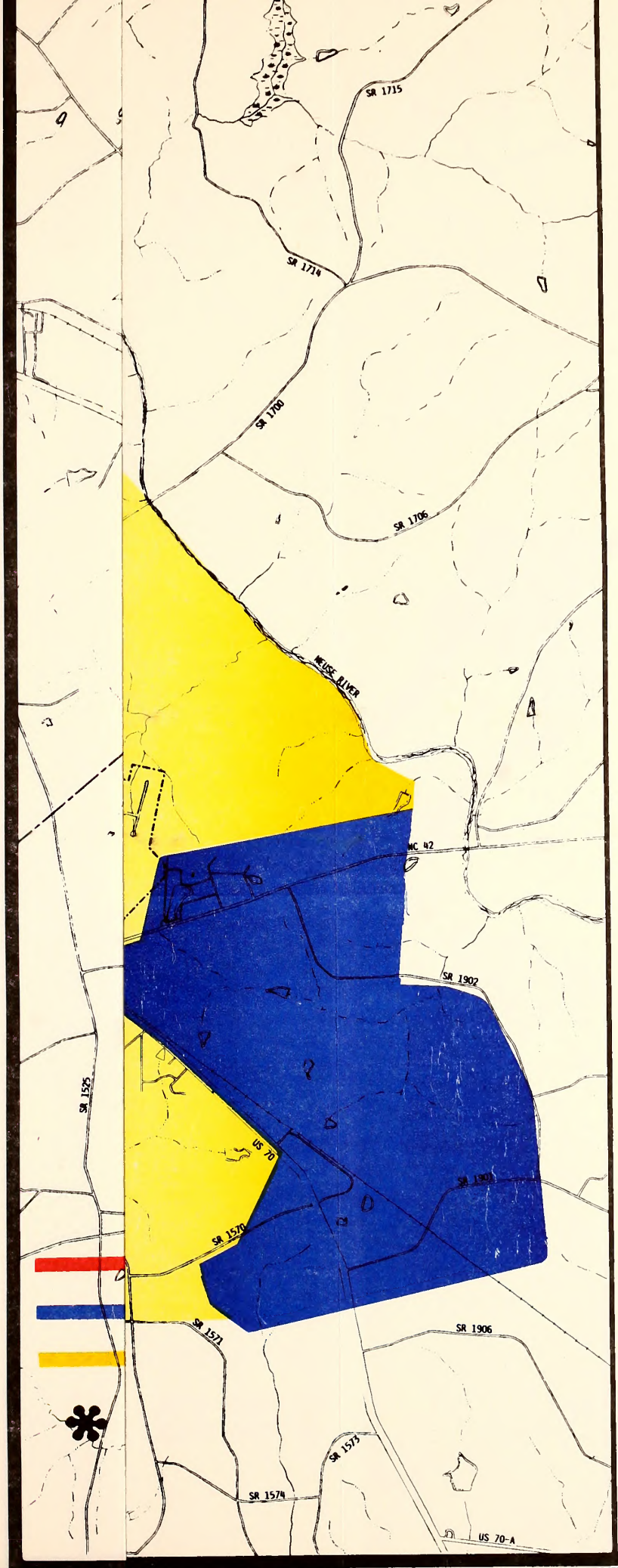


FIGURE 3

PROBABLE FUTURE LAND USE

Town Of

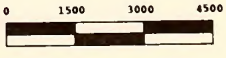
CLAYTON

Johnston County
North Carolina

Prepared By The
North Carolina Department of Transportation
Division of Highways - Planning and Research Branch

In Cooperation With The
U. S. Department of Transportation
Federal Highway Administration

FEBRUARY 1990



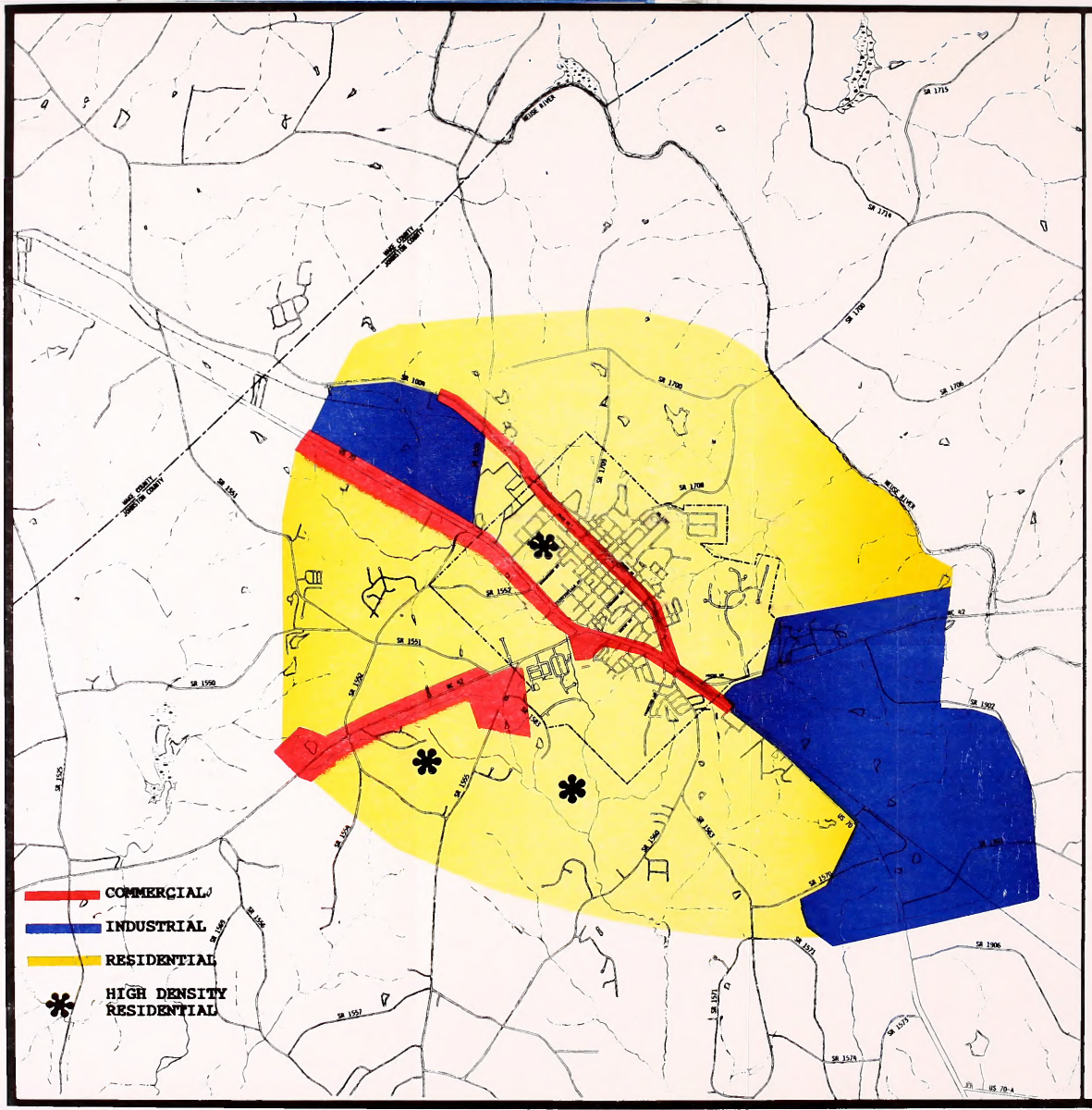


FIGURE 3

PROBABLE FUTURE LAND USE

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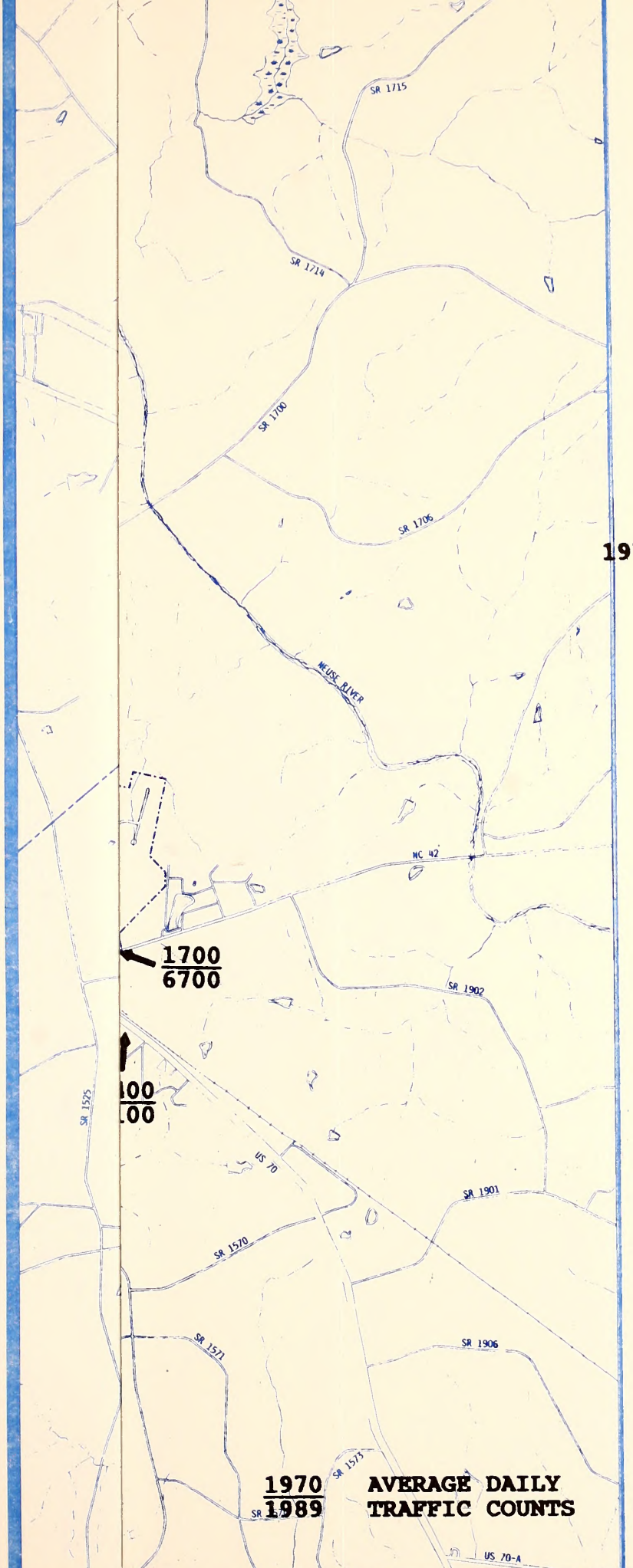

FIGURE 4

1970/1989 TRAFFIC COUNTS

Town Of

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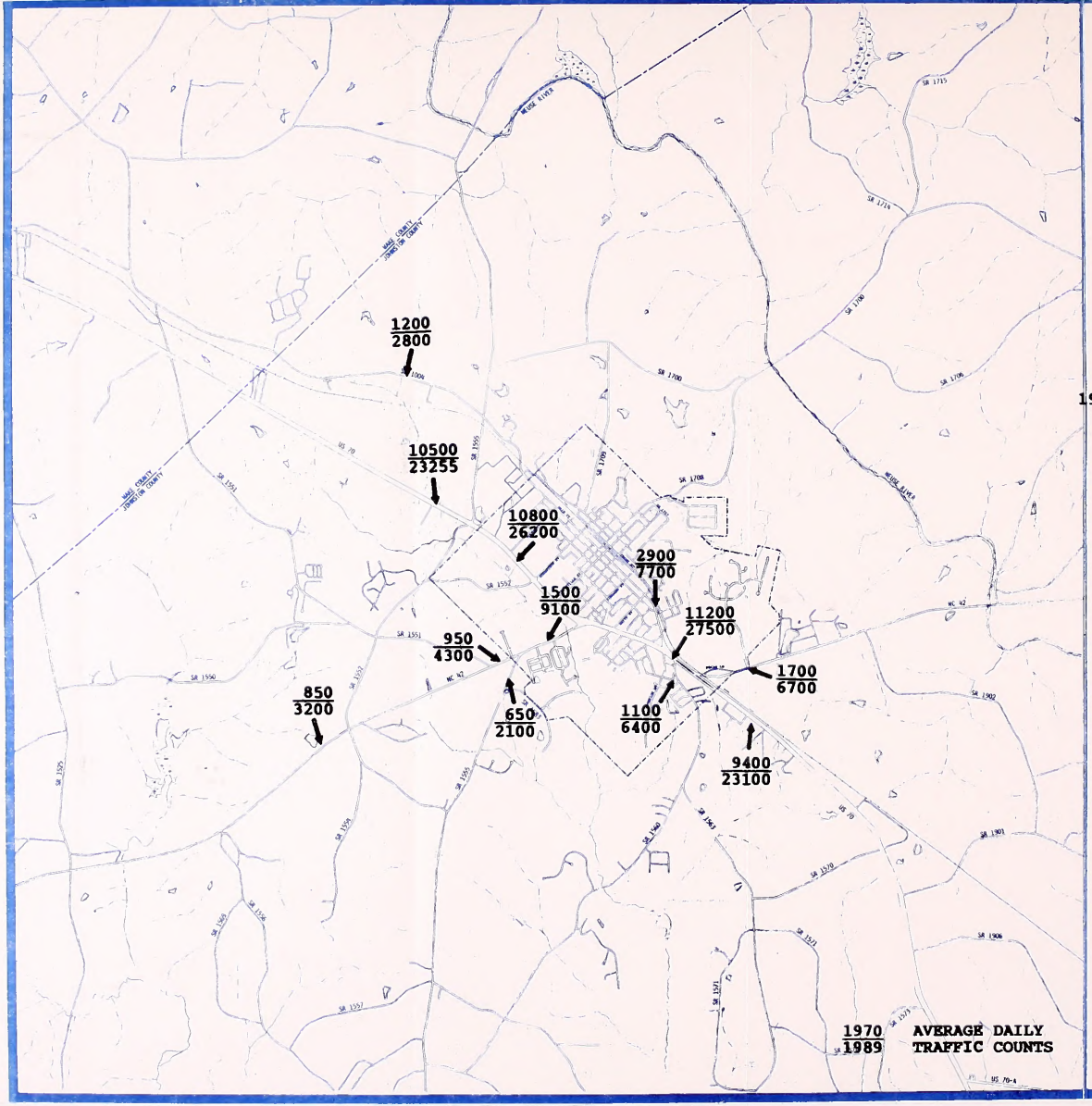

FIGURE 4

1970/1989 TRAFFIC COUNTS

Town Of

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FEBRUARY 1990

PROJECTED

TRAFFIC COUNTS

2010 ADT

E: COUNTS REFLECT
AFFECT OF PROPOSED
US 70 BYPASS

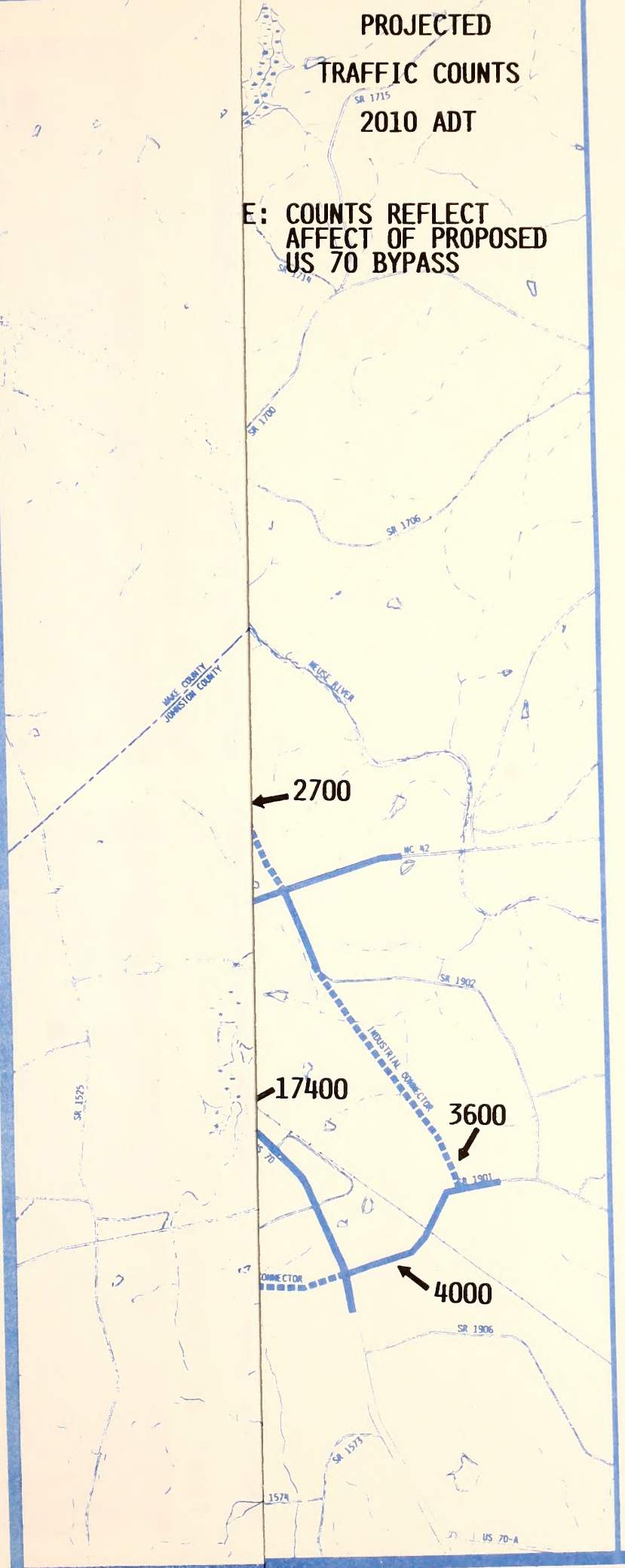

FIGURE 5

THOROUGHFARE PLAN

LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		

ADOPTED BY:

PUBLIC HEARING AUGUST 6, 1990

TOWN OF CLAYTON AUGUST 6, 1990

RECOMMENDED APPROVAL BY PLANNING AND ENVIRONMENTAL BRANCH AUGUST 7, 1990

ADOPTED BY N.C. DEPARTMENT OF TRANSPORTATION SEPTEMBER 7, 1990

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AUGUST 6, 1990

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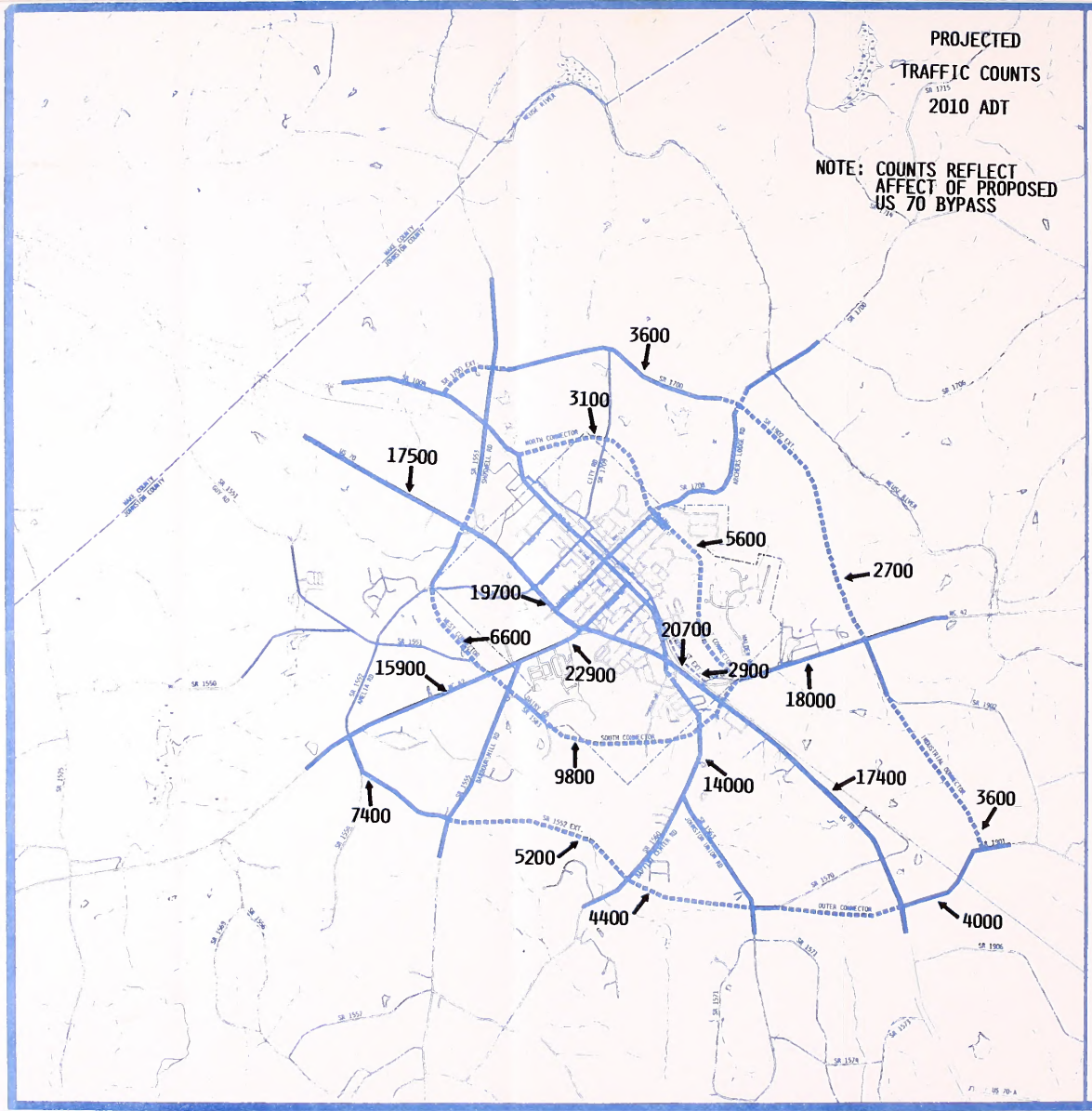

FIGURE 5

THOROUGHFARE PLAN

	EXISTING	PROPOSED
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		

ADOPTED BY:
PUBLIC HEARING AUGUST 6, 1990
TOWN OF CLAYTON AUGUST 6, 1990
RECOMMENDED APPROVAL BY PLANNING AND ENVIRONMENTAL BRANCH AUGUST 7, 1990
ADOPTED BY N.C. DEPARTMENT OF TRANSPORTATION SEPTEMBER 7, 1990

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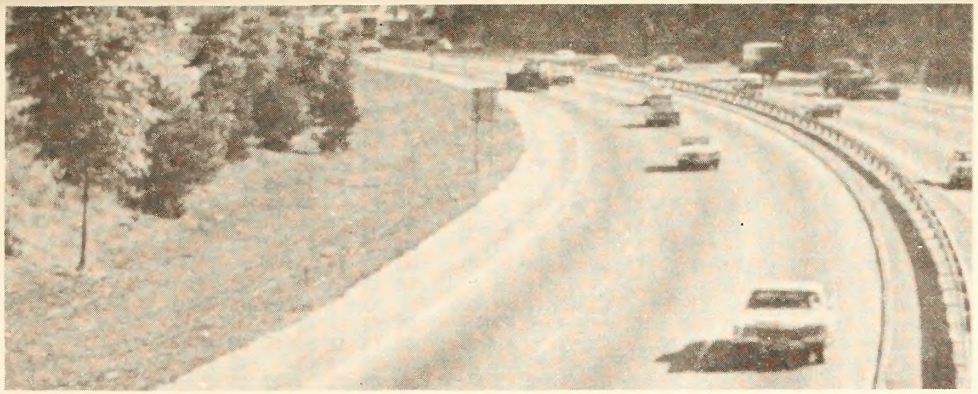
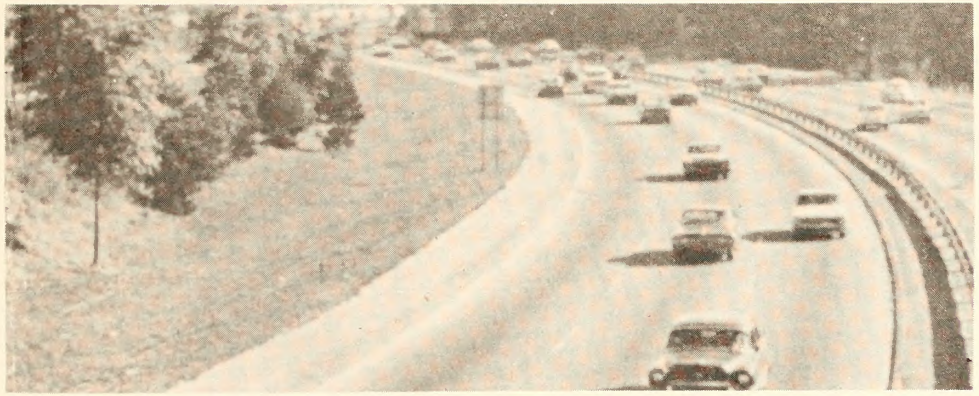


LEVEL OF SERVICE - A

LEVEL OF SERVICE - D



LEVEL OF SERVICE - B

LEVEL OF SERVICE - E

LEVEL OF SERVICE - C

LEVEL OF SERVICE - F

LEVELS OF SERVICE

IV. RECOMMENDATIONS

As discussed in previous chapters, the goal of thoroughfare planning is to design a street system which will handle traffic efficiently and safely. A basic understanding of the travel patterns within an area enables the planner to evaluate the existing street system and make improvement recommendations. The Clayton street system is characterized by radial streets feeding into the downtown area. The primary problem with this type of system is that traffic from outlying areas must travel downtown to get to other radial streets. Clayton has the added problem of through traffic along US 70 that competes with local traffic movement in the downtown area. A system of connector roads can relieve downtown congestion by providing routes designed specifically to carry crosstown traffic. Savings in time and operating costs are benefits associated with an efficient connector system. The following street improvements will provide a balanced street system and reduce the possibility for congestion in the downtown area. Please consult Figure 7 and Table 3 for additional information on specific projects.

THOROUGHFARE PLAN RECOMMENDATIONS

US 70 - US 70 is a four lane divided facility that roughly bisects the Clayton planning area. Traffic projections for this portion of US 70 indicate that the US 70 Bypass of Clayton, scheduled in the Transportation Improvement Program, will soon be needed. The thoroughfare plan, developed to complement the bypass project, does not address the details of the bypass since the environmental study in progress is more precise than that conducted for a typical thoroughfare plan. Corridors to the north and south of Clayton are under consideration in the environmental study and either would work well with the Thoroughfare Plan. However, a route to the south would provide better service to the locally generated commuter travel. Raleigh acts as a magnet drawing a portion of her work force from the Clayton area. As the bulk of residential development around Clayton continues to the south and west of Town, this pattern of commuter travel will become more apparent. The existing US 70 corridor will likely become a business route serving the local travel needs. It is important to note that some control of access is fundamental to achieving a high level of travel service. Continuous driveway connections along the existing US 70 corridor will severely impair the ability of the road to carry traffic. In order to maintain the current quality of service along the existing US 70 corridor, strip development should be avoided.

SR 1552 Extension - The extension of SR 1552 will create a continuous southern route between NC 42 and US 70. Service to the rapidly developing residential areas south of Clayton will be vital in years to come. This two lane facility will reduce travel costs and travel time as traffic is routed around the downtown area. Upon completion of the US 70 Bypass, the extension will provide convenient access to the proposed interchanges with the bypass. Access will be

a key feature in attracting commercial and industrial development to the bypass area. Lack of good access to the areas around the bypass could negatively impact Clayton's economic future.

Industrial Connector - Already recognized as an area prime for industrial development, the southeastern portion of the planning area is in dire need of a facility to connect its ends. The industrial connector will provide a direct two lane route between NC 42 and US 70 thus consolidating the area as an industrial section. Local individuals employed by these companies will also enjoy the convenience of a connector which operates well with the existing street system.

SR 1902 Extension - Intersecting both NC 42 and SR 1708, the extension of SR 1902 will provide service to the residential communities developing in the northeastern portion of the planning area. In addition, the road will work well with a bypass location to the north, much the same way the SR 1552 Extension would for a southern bypass location. Should the proposed Southern Wake Expressway (Greater Raleigh Urban Area Thoroughfare Plan) come to fruition, the northern areas of Clayton will rapidly develop. The extension of SR 1902 will be the vital link creating a continuous two lane route around northern Clayton that will carry traffic to the expressway. Sight distance improvements along SR 1708 as well as the realignment of the SR 1700 intersection should be included in this project as safety considerations.

SR 1700 Extension - As an accompaniment to the entire northern system of connectors, the extension of SR 1700 to SR 1004 will be very beneficial upon construction of the proposed Southern Wake Expressway. This short two lane project will provide a continuous route to SR 1004 and will split the traffic burden otherwise placed on the poorly aligned intersection of SR 1004 and SR 1553.

North Connector - Skirting the northern town limits of Clayton the North Connector intersects SR 1004, SR 1709, and SR 1708, thus providing convenient travel between these radials. The connector will likely encourage development in adjacent land areas. Average daily traffic along this two lane connector is expected to be 3100 vehicles per day by 2010. This estimate, although lower than estimates for other segments of the connector system, is consistent with existing traffic patterns.

East Connector - As a major route linking dense residential development with NC 42 and ultimately US 70, the East Connector will be of great benefit to the transportation system. This two lane facility will drastically cut travel time by eliminating the need for unnecessary trips downtown. Development along the East Connector will be limited since the surrounding areas are almost saturated, but future year traffic projections of 5600 on this facility show that it will benefit the community. As part of this project, improvements to SR 1708 (see Figure 7) will provide a continuous radial to the downtown area.

South Connector - This two lane facility stretches across the southern portion of Clayton between NC 42 and US 70. In keeping with the main purpose of a connector type road, the South Connector will carry traffic from the highly developed residential areas to various commercial and industrial areas. Traffic projections of 9800 vehicles per day along portions of the connector indicate that this will be a valuable addition to Clayton's transportation system.

West Connector - In the western portion of Clayton, the West Connector will operate as a two lane link between US 70 and NC 42. In recent years, several subdivisions have located in this area. The connector will open up additional land for development and will provide better access to the elementary school and the proposed middle school. On an average day in the design year, this facility is expected to carry 6600 vehicles. Other improvements should include realignment of the US 70/SR 1553 intersection as well as sight distance improvements at SR 1552.

Front Street Extension - Extension of the existing Front Street will reduce traffic volumes at the Main Street\US 70 intersection where accidents are already a problem. With increased through traffic expected to use US 70, the Front Street Extension will be a timely project if implemented before construction of the US 70 Bypass. Should construction of the bypass precede efforts to extend Front Street, a reevaluation of the project will be necessary to determine its benefits.

SR 1563 Widening and Intersection Improvements - The existing lane widths along SR 1563 will not be sufficient to handle its projected traffic volumes. Overload during peak hours may cause breakdowns on SR 1563 and the connector system. By widening to a four lane facility, this radial will be able to carry future traffic volumes. Historically, the Main Street\US 70 and SR 1563\US 70 intersections have been plagued with high accident rates. Part of the problem lies in the complexity of this "dog-leg" intersection. Driver confusion and high traffic volumes are no mix. The realignment of SR 1563 will create a standard type intersection which should reduce driver confusion and decrease the potential for traffic conflict.

Widening Projects - Widening is a cost effective way to increase the capacity of a road and creates safer operational conditions for roads not meeting width standards. Many of the roads in Clayton do not meet the width requirements of the North Carolina Department of Transportation. The projects listed below are widening projects that will positively influence the effectiveness of the connector system outlined previously. Widening of other deficient roadways should be considered as growth and development continue. Detailed analysis and recommendations for the following projects are listed in Table 3.

SR 1700 Widening - SR 1700 is a two lane road with nine foot lanes. It intersects SR 1553 and SR 1708 thus completing the outer connector around the northern portion of Clayton. Lane widths of twelve feet are desirable for this facility.

SR 1901 Widening - SR 1901 is a two lane facility connecting US 70 and the proposed Industrial Connector. Widening the existing twenty foot roadway to twenty-four feet will be necessary in order to safely accommodate the heavy truck traffic expected to use this facility.

SR 1552 Widening - The two lane facility extending between NC 42 and SR 1555 currently has nine foot lane widths. The lane widths need to be widened to twelve feet.

NC 42 Widening - Traffic demand along NC 42 is expected to more than double in the next twenty years. This demand will be the result of continued economic growth and the growth associated with the US 70 Bypass project. Interchanges with freeway type facilities attract development and the NC 42 \ US 70 interchange will be no exception. Widening NC 42 to a four lane facility with twelve foot lanes will increase the capacity of this roadway to roughly 22,000 vehicles per day, more than enough to contend with expected demand.

Construction Improvements and Cost Estimates

The improvements suggested in the Clayton Urban Area Thoroughfare Plan obviously cannot be undertaken all at once, nor should they be. The cost would be overwhelming and the need for many of the improvements is not immediate. In an effort to reflect the relative value of various improvements, an assessment has been made of the benefits that can be expected from each project. These benefits can then be compared to the projected costs involved.

Three principal measures of benefits were used: road user cost savings, the potential for increased economic development resulting from the improvement, and the environmental impact, both positive or negative, which might result. The first measure is an actual estimate of dollar savings, while the others are estimates of the probability of the resulting change.

Reduced road user costs should result from any roadway improvement, from a simple widening to the construction of a new roadway to relieve congested or unsafe conditions. Comparisons of the existing and the proposed facility have been made in terms of vehicle operating costs, travel time costs, and accident costs. These user benefits are computed as total dollar savings over the 20 year design period using data such as project length, base year and design year traffic volumes, traffic speed, type of facility, and volume/capacity ratio.

The impact of a project on economic development potential is denoted as the probability that it will stimulate the economic development of an area by providing access to land with development potential and reducing transportation costs. It is a subjective estimate based on the knowledge of the proposed project, local

development characteristics, and land development potential. The probability is rated on a scale from 0 (none) to 1.00 (excellent).

The environmental impact analysis considers the effect of a project on the physical, social/cultural, and economic environment. Many of these have been accounted for in evaluating the project with respect to user benefits, cost, and economic development potential. The environmental analysis evaluates the impact of the project on the following: (1) air quality, (2) water resources, (3) soils and geology, (4) wildlife, (5) vegetation, (6) neighborhoods, (7) noise, (8) educational facilities, (9) churches, (10) parks and recreational facilities, (11) historic sites and landmarks, and (12) public health and safety. The summation of both positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impact of a project.

ENVIRONMENTAL CONSIDERATIONS

Physical Environment

Air quality
Water Resources
Soils and Geology
Wildlife
Vegetation

Social and Cultural Environment

Housing
Neighborhoods
Noise
Educational Facilities
Churches
Parks and Recreational Facilities
Public Health and Safety
National Defense
Aesthetics

Economic Environment

Businesses
Employment
Economic Development
Public Utilities
Transportation Costs
Capital Costs
Operation and Maintenance Costs

Offsetting the benefits that would be derived from any project is the cost of its construction. A new facility, despite its high projected benefits, might prove to be unjustified due to the excessive costs involved in construction. The highway costs estimated in this report are based on the average statewide construction costs for similar project types. An estimate of anticipated right-of-way costs is also included. Table 4 lists the proposed Clayton Thoroughfare Plan projects with respect to user benefits, estimated costs, probability of economic development, and environmental impact. Figure 9 is a pictorial representation of the environmental concerns that may influence various Thoroughfare Plan projects.

Comparisons of various projects based on the preceding criteria can be used as a guide in implementing the recommended improvements. Construction priorities will vary depending on what criteria are considered and what weight is attached to the various criteria. Most people would agree that improvements to the major thoroughfare system and major traffic routes would be more important than minor thoroughfares where traffic volumes are lower. To be in the State's Transportation Improvement Program, a project must show favorable benefits relative to costs and should not be prohibitively disruptive to the environment.

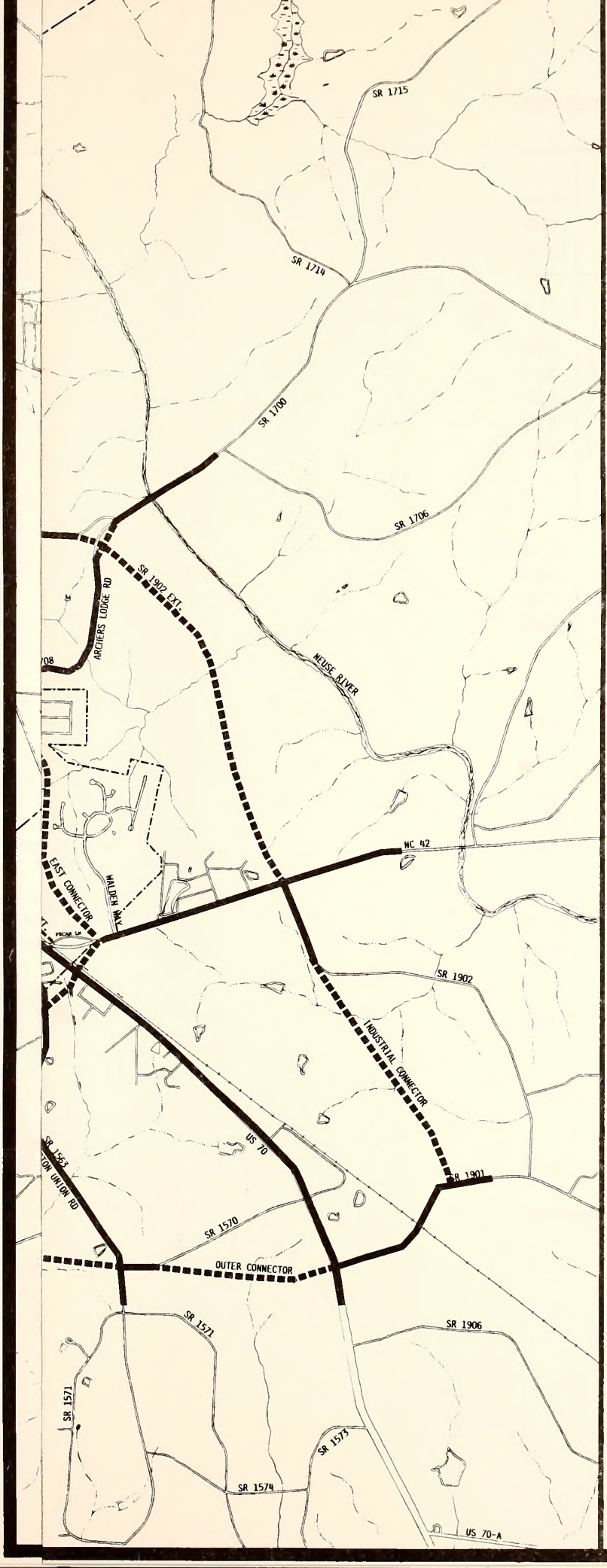


FIGURE 7

THOROUGHFARE PLAN

LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE	▬▬	▬ ▬ ▬
MINOR THOROUGHFARE	▬▬	▬ - ▬ -

ADOPTED BY:	
PUBLIC HEARING	AUGUST 6, 1990
TOWN OF CLAYTON	AUGUST 6, 1990
RECOMMENDED APPROVAL BY PLANNING AND ENVIRONMENTAL BRANCH	M R Poole AUGUST 7, 1990
ADOPTED BY N.C. DEPARTMENT OF TRANSPORTATION	SEPTEMBER 7, 1990

Town Of

CLAYTON

Johnston County
North Carolina

Prepared By The
North Carolina Department of Transportation
Division of Highways - Planning and Research Branch

In Cooperation With The
U. S. Department of Transportation
Federal Highway Administration

AUGUST 6, 1990

0 1500 3000 4500

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FIGURE 7

THOROUGHFARE PLAN

LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		

ADOPTED BY:	
PUBLIC HEARING	AUGUST 6, 1990
TOWN OF CLAYTON	AUGUST 6, 1990
RECOMMENDED APPROVAL BY PLANNING AND ENVIRONMENTAL BRANCH	AUGUST 7, 1990
ADOPTED BY N.C. DEPARTMENT OF TRANSPORTATION	SEPTEMBER 7, 1990

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AUGUST 6, 1990

0 1500 3000 4500

TABLE 3

THOROUGHFARE PLAN STREET TABULATION

FACILITY & SECTION	EXISTING X - SECTION DIST MI	RDWY FT	ROW FT	CAPACITY CURRENT (FUTURE)	1989 ADTS	2010 ADTS	RECOMMENDED X-SECTION * (IDEAL) RDWAY	ROW
US 70								
West Planning Boundary - WCL Clayton	1.60	48	200	30,000	23,300	17,500	ADQ	ADQ
WCL Clayton - NC 42 South	1.13	48	200	30,000	26,200	19,700	ADQ	ADQ
NC 42 South - NC 42 North	0.98	48	200	30,000	27,500	20,700	ADQ	ADQ
NC 42 North - ECL Clayton	0.21	48	200	30,000	23,100	17,400	ADQ	ADQ
ECL - E. Planning Boundary	2.47	48	150	30,000	23,100	17,400	ADQ	ADQ
NC 42 WIDENING								
South Planning Boundary - WCL Clayton	1.80	20	100	(22,000)	3,800	15,900	H	ADQ
WCL Clayton - US 70	0.65	24	100	(22,000)	9,100	22,900	H	ADQ
US 70 - ECL Clayton	0.31	20	100	(22,000)	6,700	18,000	H	ADQ
ECL Clayton- East Planning Boundary	1.71	24	100	(22,000)	5,500	18,000	H	ADQ
SR 1552 WIDENING								
NC 42 - SR 1555	1.08	18	60	(13,000)	500	4,000	L	100
SR 1552 EXTENSION								
SR 1555 - SR 1560	1.60			(12,500)		5,200	L	100
SR 1560 - SR 1563	1.02			(12,500)		4,400	L	100
SR 1563 - US 70	1.20			(12,500)		3,200	L	100
WEST CONNECTOR								
US 70W - SR 1552 (soil)	.57	24	NA	(12,500)	250	6,600	L	100
SR 1552 - NC 42	.85			(12,500)		6,600	L	100
SOUTH CONNECTOR								
NC 42 - US 70	2.16			(12,500)		9,800	L	100
NORTH CONNECTOR								
SR 1004 - SR 1708	1.42			(12,500)		3,100	L	100
EAST CONNECTOR								
SR 1708 - NC 42	1.48			(12,500)		5,600	L	100

* See Figure 8
NA = Information Not Available
ADQ = Adequate

TABLE 3

THOROUGHFARE PLAN STREET TABULATION

FACILITY & SECTION	EXISTING X - SECTION DIST MI	RDWY FT	ROW FT	CAPACITY CURRENT (FUTURE)	1989 ADTS	2010 ADTS	RECOMMENDED X-SECTION * (IDEAL) RDWAY	ROW
SR 1902 EXTENSION SR 1708 - NC 42	2.16			(13,000)		2,700	L	100
SR 1700 WIDENING SR 1708 - SR 1553	2.10	18	60	9,000	1,600	3,600	L	100
SR 1700 EXTENSION SR 1553 - SR 1004	.47			(13,000)		1,400	L	100
INDUSTRIAL CONNECTOR NC 42 - SR 1901	1.92			(13,000)		3,600	L	100
SR 1901 WIDENING US 70 - Industrial Conn.	.85	20	NA	(13,000)	1,200	4,000	L	100
FRONT STREET EXTENSION Existing Front Street - US 70	.51			(10,500)		2,900	K	60
SR 1563 WIDENING and INTERSECTION IMPROVEMENTS US 70 - SR 1560	1.14	10	NA	(22,000)	6,400	14,000	H	70

* See Figure 8
NA = Information Not Available
ADQ = Adequate

TABLE 4

Clayton Thoroughfare Plan Cost Estimates, Benefits and Probable Impacts

DESCRIPTION	LENGTH (mile)	CONST. COST (x 1000)	ROW COST (x 1000)	USER BENEFITS (x 1000)	ECON. IMPACTS	ENVIRONMENTAL IMPACTS		
						POS.	NEG.	CONCERNS
NC 42 WIDENING	4.47	$ 6,050	$ 100	$138,000	.72	.25	.10	Stream Crossing*
SR 1552 WIDENING	1.08	$ 550	$ 150	$ 300	.60	.20	.10	No Comments
SR 1552 EXTENSION	3.84	$ 5,100	$ 1,450	$ 49,000	.80	.35	.35	Stream Crossing* R/P - 1 H, 15 MH
WEST CONNECTOR	1.42	$ 2,400	$ 500	$ 40,000	.52	.35	.25	Stream Crossing*
SOUTH CONNECTOR	2.16	$ 2,800	$ 900	$ 38,000	.68	.40	.45	Stream Crossing* R/P - 3 H
NORTH CONNECTOR	1.42	$ 1,850	$ 650	$ 5,500	.64	.35	.35	R/P - 1 H, 1 B
EAST CONNECTOR	1.48	$ 1,700	$ 800	$ 23,000	.16	.25	.40	R/P - 3 H
SR 1902 EXTENSION	2.16	$ 3,200	$ 900	$ 28,300	.76	.15	.40	Stream Crossing* R/P - 1 H
SR 1700 EXTENSION	.45	$ 1,100	$ 300	$ 1,400	.20	.15	.15	No Comments
SR 1700 WIDENING	2.10	$ 1,450	$ 200	$ 1,000	.40	.35	.10	Stream Crossing*
INDUSTRIAL CONNECTOR	1.92	$ 2,550	$ 900	$ 34,000	.80	.25	.60	Stream Crossing*
SR 1901 WIDENING	.85	$ 400	$ 350	$ 60	.76	.15	.10	No Comments
FRONT ST. EXTENSION	.51	$ 650	$ 800	$ 1,400	.10	.25	.10	R/B - 1 B
SR 1563 WIDENING & INTERSECTION IMPROV.	1.14	$ 1,450	$ 1,350	$ 20,500	.64	.25	.10	R/B - 5 H, 1 B

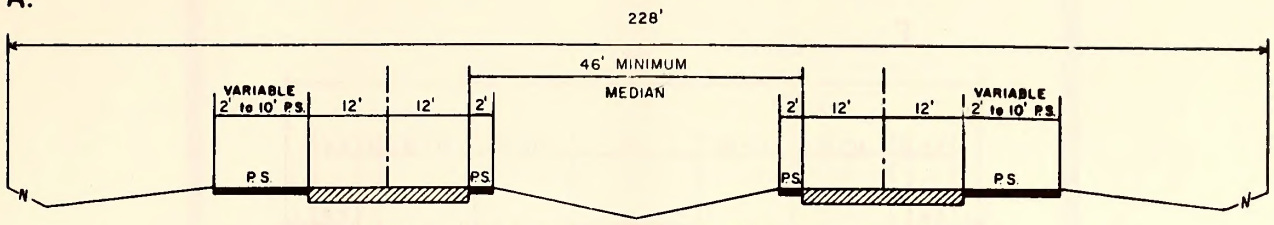
* See Figure 9

R/P - Relocation/Proximity Damage (H - House, MH - Mobile Home, B - Business)

1. User Benefits - estimated user cost of the completed project
2. Economic Impacts - subjective evaluation of the probability that a project will stimulate economic growth (Poor=0, Excellent=1)
3. Environmental Impacts - based on the probability of positive and negative impact for the environmental factors listed in Chapter IV.

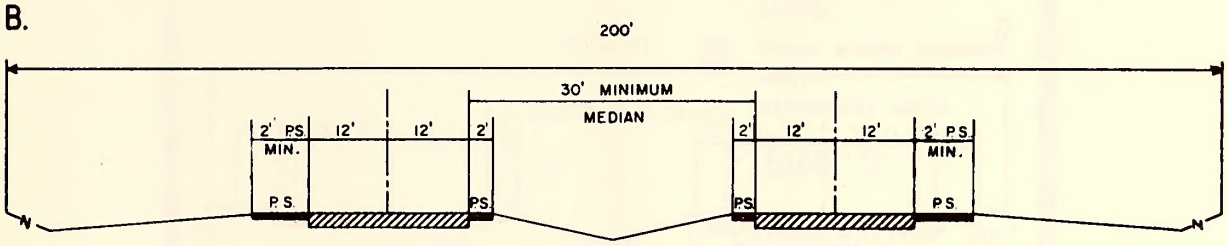
FIGURE 8
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



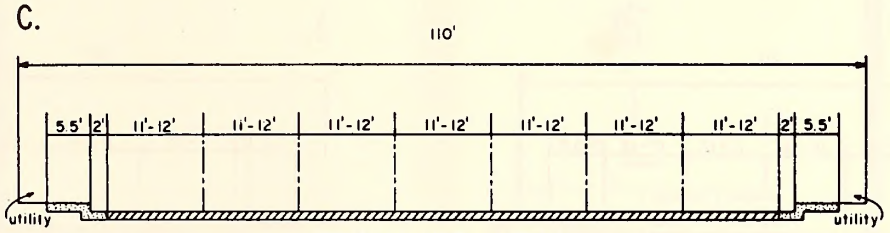
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



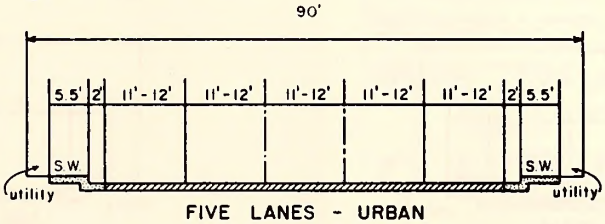
FOUR LANES DIVIDED WITH MEDIAN - RURAL

C.



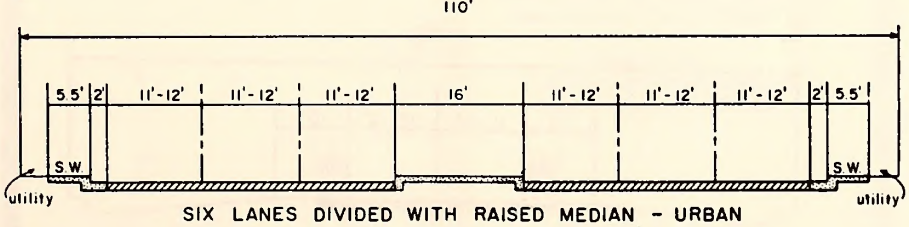
SEVEN LANES - URBAN

D.



FIVE LANES - URBAN

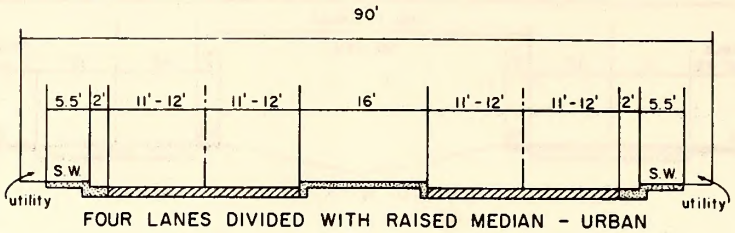
E.



SIX LANES DIVIDED WITH RAISED MEDIAN - URBAN

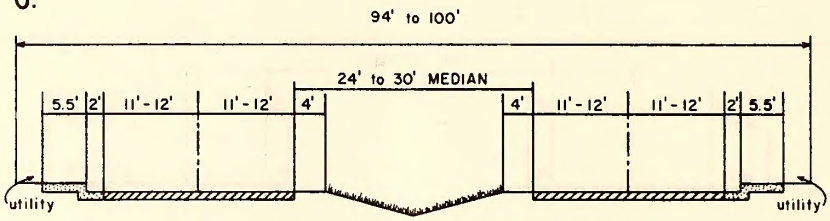
TYPICAL THOROUGHFARE CROSS SECTIONS
(CONTINUED)

F.



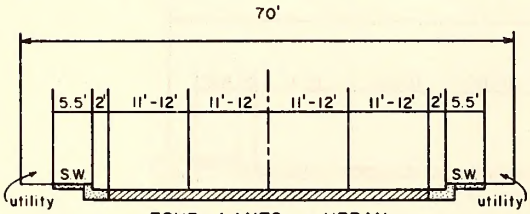
FOUR LANES DIVIDED WITH RAISED MEDIAN - URBAN

G.



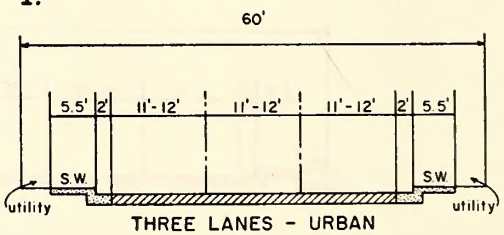
FOUR LANES DIVIDED - URBAN BOULEVARD
GRASS MEDIAN

H.



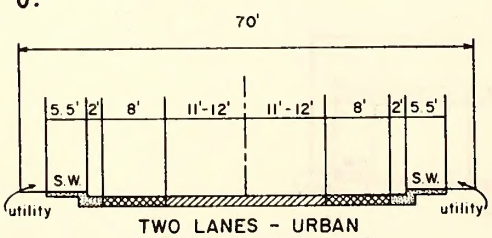
FOUR LANES - URBAN

I.



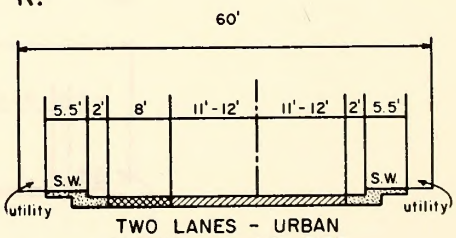
THREE LANES - URBAN

J.



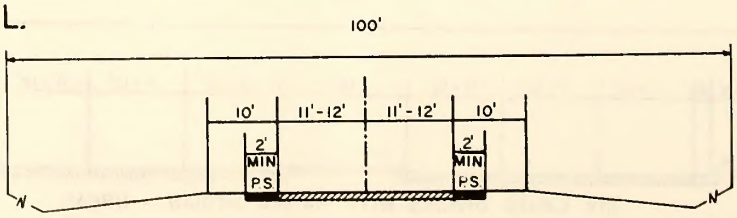
TWO LANES - URBAN
PARKING ON EACH SIDE

K.

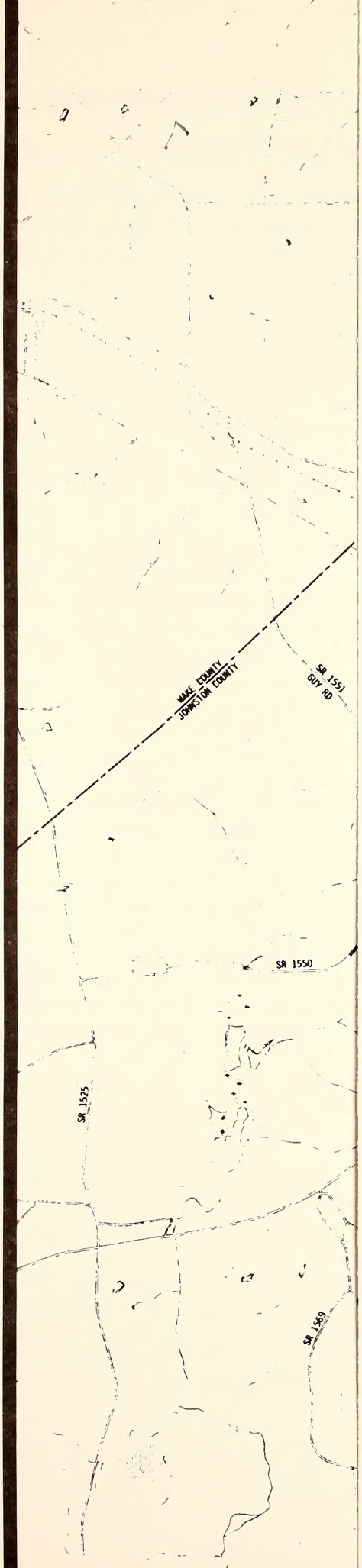


TWO LANES - URBAN
PARKING ON ONE SIDE

L.



TWO LANES - RURAL



LEGEND

- MAJOR STREAM CROSSING
- PARKS
- HISTORICAL SITES

FIGURE 9

ENVIRONMENTAL CONCERNS

LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		

ADOPTED BY:

PUBLIC HEARING AUGUST 6, 1990

TOWN OF CLAYTON AUGUST 6, 1990

RECOMMENDED APPROVAL BY PLANNING AND ENVIRONMENTAL BRANCH AUGUST 7, 1990

ADOPTED BY N.C. DEPARTMENT OF TRANSPORTATION SEPTEMBER 7, 1990

Town Of

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Prepared By The
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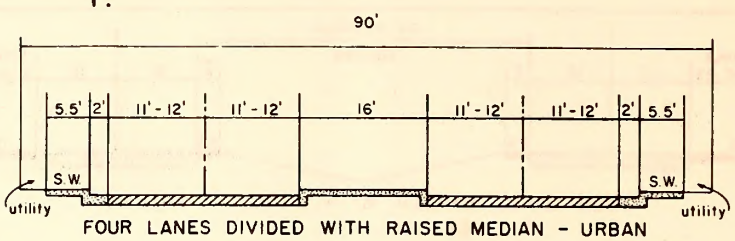
AUGUST 6, 1990

0 1500 3000 4500

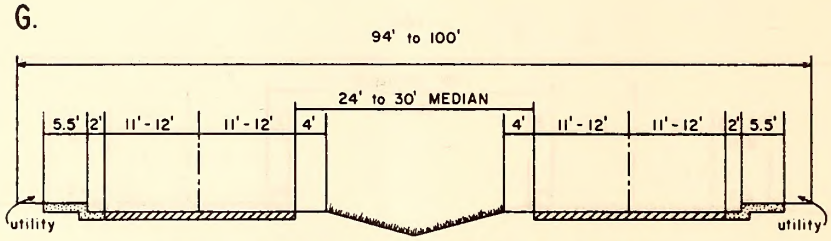
TYPICAL THOROUGHFARE CROSS SECTIONS
(CONTINUED)

F.



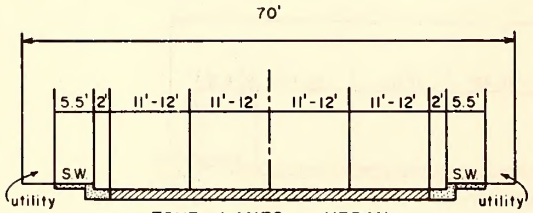
FOUR LANES DIVIDED WITH RAISED MEDIAN - URBAN

G.



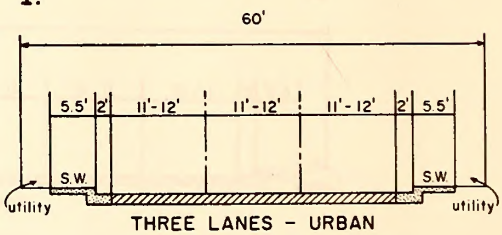
FOUR LANES DIVIDED - URBAN BOULEVARD
GRASS MEDIAN

H.



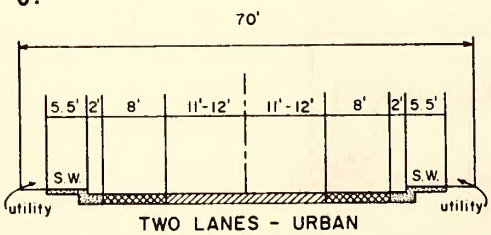
FOUR LANES - URBAN

I.



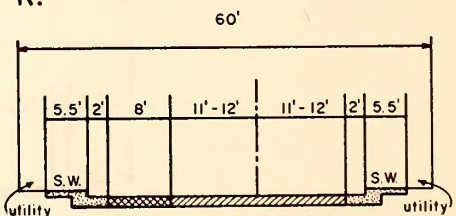
THREE LANES - URBAN

J.



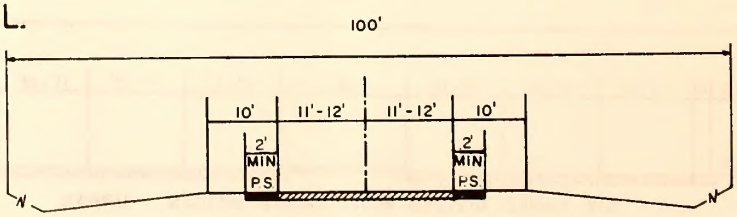
TWO LANES - URBAN
PARKING ON EACH SIDE

K.



TWO LANES - URBAN
PARKING ON ONE SIDE

L.



TWO LANES - RURAL

LEGEND

LEGEND

MAJOR STREAM CROSSING

PARKS

HISTORICAL SITES

FIGURE 9

ENVIRONMENTAL CONCERNS

N

LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		

ADOPTED BY:

PUBLIC HEARING AUGUST 6, 1990

TOWN OF CLAYTON AUGUST 6, 1990

RECOMMENDED APPROVAL BY PLANNING AND DEVELOPMENTAL BOARD AUGUST 7, 1990

ADOPTED BY N.C. DEPARTMENT OF TRANSPORTATION SEPTEMBER 7, 1990

Town Of

CLAYTON

Johnston County
North Carolina

Prepared By The
North Carolina Department of Transportation
Division of Highways - Planning and Research Branch

In Cooperation With The
U. S. Department of Transportation
Federal Highway Administration

AUGUST 6, 1990

0 1500 3000 4500

V. ADMINISTRATIVE CONTROLS AND IMPLEMENTATION TOOLS

State and Municipal Adoption of the Thoroughfare Plan

Chapter 136, Article 3A, Section 136-66.2 of the General Statutes of North Carolina provides that after development of a thoroughfare plan, the plan may be adopted by the governing body of the municipality and the Department of Transportation to serve as the basis for future street and highway improvements. The General Statutes also require that, as part of the plan, the governing body of the municipality and Department of Transportation shall reach agreement on responsibilities for existing and proposed streets and highways included in the plan. Facilities which are designated a State responsibility will be constructed and maintained by the Division of Highways. Facilities which are designated a municipal responsibility will be constructed and maintained by the municipality.

After mutual plan adoption, the Department of Transportation will initiate negotiations leading to determining which of the existing and proposed thoroughfares will be a Department responsibility and which will be a municipal responsibility. Chapter 136, Article 3A, Section 136-66.1 of the General Statutes provides guidance in the delineation of responsibilities. In summary, these statutes provide that the Department of Transportation shall be responsible for those facilities that serve volumes of through traffic and traffic from outside the area to major business, industrial, governmental, and institutional destinations located inside the municipality. The municipality is responsible for those facilities that serve primarily internal travel.

Unless implementation is an integral part of the transportation planning process, the effort and expense associated with developing a plan is lost. To neglect the implementation process is a three-fold loss - the loss of the capital expenditures used in developing a plan, the opportunity cost of the capital expenditures, and more importantly the loss of the benefits that would accrue from an improved transportation system.

Administrative controls and implementation tools that can aid in the implementation process are generally available to municipalities through Federal and State Legislation. These controls and tools will be discussed in this chapter. They include: Subdivision Regulations, Zoning Ordinances, Official Maps, Urban Renewal, Capital Improvements Programs, and Development Reviews. Generally two issues play a major role in the implementation process - available finances and citizen involvement. Effective use of the controls and tools listed above are indicative of good planning and minimize the effects of limited finances and negative citizen reaction to specific elements of a plan. It is through good planning that maximum use is made of every available dollar and that citizen involvement and approval of the transportation plan is obtained.

Available Controls and Tools

Subdivision Regulations

Subdivision regulations are locally adopted laws governing the process of converting raw land into building sites. From the planner's view, subdivision regulations are important at two distinct levels. First, they enable him to coordinate the otherwise unrelated plans of many individual developers. This process assures that provision is made for land development elements such as roadway right-of-way, parks, school sites, water lines and sewer outfalls, and so forth. Second, they enable him to control the internal design of each new subdivision so that its pattern of streets, lots, and other facilities will be safe, pleasant, and economical to maintain.

To be most effective, subdivision regulations and their administration must be closely coordinated with other local governmental policies and ordinances. Among the more important of these are the Comprehensive Growth Plan, Utilities Extension Master Plan, and Thoroughfare Plan.

In practice, subdivision regulations can provide some very positive benefits such as requiring portions of major streets to be constructed in accordance with the Thoroughfare Plan, or requiring subdividers to provide for the dedication and/or reservation of rights-of-way in advance of construction. These practices reduce the overall cost of the plan by having some costs borne by developers. Recommended Subdivision Ordinances are included in Appendix B.

Zoning Ordinances

Zoning is probably the single most commonly used legal device available for implementing a community's land-use plan. To paraphrase the U.S. Department of Commerce 1924 Standard Zoning Enabling Act, on which most present-day legislation is based, zoning may be defined as the division of a municipality (or other governmental unit) into districts, and the regulation within the districts of:

1. the height and bulk of buildings and other structures,
2. the area of a lot that may be occupied and the size of required open spaces,
3. the density of population, and
4. the use of buildings and land for trade, industry, residence, or other purposes.

The characteristic feature of the zoning ordinance that distinguishes it from most other regulations is that it differs from district to district, rather than being uniform throughout a city. Thus, a given area might be restricted to single-family residential development with minimum lot size requirements and setback provisions appropriate for development. In other areas, commercial or industrial development might be permitted, and regulations would be enacted to control such development. Building

sanitary regulations, on the other hand, normally apply to all buildings in a certain category regardless of where they may be situated within a city.

The zoning ordinance does not regulate the design of streets, utility installation, the reservation or dedication of parks, street rights-of-way, school sites, and related matters. These are controlled by subdivision regulations or possibly by use of an official map. The zoning ordinance should however, be carefully coordinated with these and other control devices.

Official Maps

The roadway corridor official map (or official map) is a document, adopted by the legislative body of the community, that pinpoints and preserves the location of proposed streets against encroachment. In effect, the official map serves notice on developers that the State or municipality intends to acquire certain specific property. The official map serves as a positive influence for sound development by reserving sites for public improvements in anticipation of actual need.

The NCDOT position is that it will limit the use of official maps to large scale, fully access controlled facilities planned for rapidly developing areas outside of municipal jurisdictions. For projects within municipal jurisdictions, official maps should be prepared and adopted by the local government. Municipalities may adopt official maps that extend beyond its extraterritorial jurisdiction with approval from the Board of County Commissioners.

It should be recognized that an official map places severe but temporary restrictions on private property rights. These restrictions are in the form of a prohibition, for up to three years, on the issuance of building permits or the approval of subdivisions on property lying within an official map alignment. The three year reservation period begins with the request for development approval. This authority should be used carefully and only in cases where less restrictive powers are found to be ineffective.

Requests for NCDOT to prepare and adopt an official map should be directed to the manager of the Program and Policy Branch. For cities contemplating the adoption of an official map, there are two ways in which the city may proceed. The first is to consider the official map statute as a stand-alone authority and use it as the basis for local adoption of an official map. Alternatively, the second approach is to adopt a local ordinance modeled after the statute, but modified to fit local circumstances and clarify the statute. Regardless of the approach taken, several procedural steps will need to be considered, such as establishing procedures for consideration of variance petitions.

Once the project has been selected and the alignment determined, maps must be prepared that are suitable for filing with the county Register of Deeds Office. The map should show the proposed alignment

in sufficient detail to identify the functional design and the preliminary right-of-way boundaries. Since the purpose of the map is to show the effect on properties along the project path, the existing property boundaries should be identified. As an additional requirement, within one year of the adoption of an official map, work must begin on an environmental impact study or preliminary engineering.

It is important to recognize the risks inherent in the adoption of an official map prior to completing the environmental studies. Projects to be funded using any federal funds require the unbiased evaluation of alternate alignments. This means that other alternatives will be studied and compared to the protected alignment.[1]

The above information is only to serve as an introduction to official maps, and in no way provides the information necessary to begin development of an official map. The Program and Policy Branch of the North Carolina Department of Transportation is responsible for facilitating the adoption of Official Street Maps. Cities considering Official Street Map projects should contact this Branch for their "Guidelines for Municipalities Considering Adoption of Roadway Corridor Official Maps" at:

Programming and Policy Branch
NC Department of Transportation
P.O. Box 25201
Raleigh, North Carolina 27611

Urban Renewal

Urban renewal plays a minor role in the transportation planning implementation process in terms of scope and general influence. However, under the right circumstances, renewal programs can make significant contributions. Provisions of the New Housing Act of 1974 (as amended) call for the conservation of good areas, rehabilitation of declining areas, and clearance of slum areas. In the course of renewal, it is important to coordinate with the Thoroughfare Plan to see if additional set-back or dedication of right-of-way is needed.

Continued use of the urban renewal programs to improve the transportation system is encouraged. Changes that can be made under this program are generally not controversial or disruptive given the trauma of the clearance of a significant area.

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[1] "Guidelines for Municipalities Considering Adoption of Roadway Corridor Official Maps," prepared by NCDOT Program and Policy Branch.

Capital Improvement Programs

Capital programs are simply the coordination of planning and money. The capital improvements program, with respect to transportation, is a long range plan for the spending of money on street improvements, acquisition of rights-of-way and other improvements within the bounds of projected revenues. Municipal funds should be available for construction of street improvements which are a municipal responsibility, right-of-way cost sharing on facilities designated a Division of Highways responsibility and advance purchase of right-of-way where such action is warranted.

Historically, cities and towns have depended, to a great degree, on Federal or State funding to solve their transportation problems. Chapter 136-Article 3A of the Road and Highway Laws of North Carolina clearly outlines the responsibilities and obligations of the various governmental bodies regarding highway improvements. North Carolina Highway Bill 1211, passed in 1988, limits the role of municipalities in right-of-way cost sharing for projects once they are programed in the NCDOT Transportation Improvement Program. Set-back regulations, right-of-way dedications and reservations play a major role in the ultimate cost of many facilities. Only in special cases will the municipality be able to enjoy the benefits of highway improvements without some form of investment.

Development Reviews

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the North Carolina Department of Transportation prior to access being allowed. Any development expected to generate large volumes of traffic (ie. shopping centers, fast food restaurants, large industries, etc.) may be comprehensively studied by staff from the Traffic Engineering, Planning and Environmental, and Roadway Design Branches of NCDOT. If done at an early stage, it is often possible to significantly improve the development's accessibility at minimal expense. Since the municipality is the first point of contact for developers, it is important that the municipality advise them of this review requirement and cooperate in the review process.

Other Funding Sources

1. Assess user impact fees to fund transportation projects. These fees, called "facility fees" in the legislation, are to be based upon "reasonable and uniform considerations of capital costs to be incurred by the town as a result of new construction. The facility fee must bear a direct relationship to additional or expanded public capital costs of the community service facilities to be rendered for the inhabitants, occupants of the new construction, or those associated with the development process."

2. Enact a bond issue to fund street improvements.

3. Continue to work with NCDOT to have local projects included in the Transportation Improvement Program (TIP).

4. Consider the possibility of specific projects qualifying for federal demonstration project funds.

5. Adopt a collector street plan that would assess buyer or property owners for street improvement.

6. Charge a special assessment for utilities; for example, increase water and sewer bills to cover cost of street improvements.

APPENDIX A

APPENDIX A

Typical Cross Sections

Typical cross sections recommended by the Thoroughfare Planning Unit are shown in Appendix A, Figure 8, and listed in Table 3.

Cross section "A" is illustrative for controlled access freeways. The 46 foot grassed median is the minimum median width. Wider variations could result depending upon design considerations. Slopes of 8:1 into 3 foot drainage ditches are desirable for traffic safety. Right-of-way requirements would typically vary upward from 250 feet depending upon cut and fill requirements.

Cross section "B" is typical for four lane divided highways in rural areas which may have only partial or no control of access. The minimum median width for this cross section is 30 feet, but a wider median is desirable. Design requirements for slopes and drainage would be similar to cross section "A", but there may be some variation from this depending upon right-of-way constraints.

Cross section "C", seven lane urban, and cross section "D", five lane urban, are typical for major thoroughfares where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

Cross sections "E" and "F" are used on major thoroughfares where left turns and intersecting streets are not as frequent. Left turns would be restricted to a few selected intersections.

Cross section "G" is recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 24 feet is recommended with 30 feet being desirable.

Typical cross section "H" is recommended for major thoroughfares where projected travel indicates a need for four travel lanes, but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane probably would be required at major intersections.

Thoroughfares which are proposed to function as one-way traffic carriers would typically require cross section "I". Cross section "J" and "K" are usually recommended for minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "J" would be used on those minor thoroughfares where parking on both sides is needed as a result of more concentrated development.

Cross section "L" is used in rural areas or for staged construction of a wider multilane cross section. On some thoroughfares projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time.

The curb and gutter cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk further away from the street to provide added separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

Rights-of-way shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

If there is sufficient bicycle traffic along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to allow for the bicycle facilities. The North Carolina Bicycle Facility and Program Handbook should be consulted for design standards for bicycle facilities.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service and available right-of-way.

APPENDIX B

APPENDIX B

RECOMMENDED SUBDIVISION ORDINANCES

Definitions

I. Streets and Roads:

A. Rural Roads

1. Principal Arterial - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of interstate routes, intrastate routes, and other routes designated as principal arterials.

2. Minor Arterial - A rural roadway joining cities and larger towns and providing intrastate and intercounty service at relatively high overall travel speeds with minimum interference to through movement.

3. Major Collector - A road which serves major intracounty travel corridors and traffic generators and provides access to the arterial system.

4. Minor Collector - A road which provides service to small local communities and traffic generators and provides access to the major collector system.

5. Local Road - A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of interstate, intrastate, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. Minor Thoroughfares - Minor thoroughfares perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.

3. Local Street - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

C. Specific Type Rural or Urban Streets

1. Freeway - Divided multilane roadways designed to carry large volumes of traffic at high speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. (Design speed 70 mph, Operating speed 55 mph)

2. Secondary Freeway - A divided multilane roadway designed to carry moderate volumes of traffic at moderate speeds. The facility provides for the continuous flow of traffic through full control of access and the provision of interchanges or grade separation with no access at cross roads, and no traffic signals. (Design speed 50-55 mph, Operating speed 40-45 mph)

3. Parkway - A divided multilane roadway designed for noncommercial traffic, with full or partial control of access. Grade separations are provided at major intersections and there are no traffic signals.

4. Expressway - A divided multilane roadway designed to carry heavy volumes of traffic with full or partial control of access. Interchanges are provided at major intersections. There may be access to service roads and local streets, but there will be no signalized intersections.

5. Secondary Expressway - A divided multilane roadway designed to carry moderate volumes of traffic at moderate speeds. This facility may have partial control of access with right turn in and right turn out access to abutting property, and interchanges at major intersections. Some minor intersections may have traffic signal control.

6. Urban Arterial - Multilane roadway with signalized intersections, and access to abutting property. May have grass or barrier type median, or middle left turn lane.

7. Residential Collector Street - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

8. Local Residential Street - Cul-de-sacs, loop streets less than 2,500 feet in length, or streets less than one mile in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.

9. Cul-de-sac - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.

10. Frontage Road - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.

11. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

II. Property

A. Building Setback Line - A line parallel to the street in front of which no structure shall be built.

B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot - A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plot" and "parcel".

III. Subdivision

A. Subdivider - Any person, firm, corporation or official agent thereof, who subdivides or develops any land deemed to be a subdivision.

B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein; (2) the division of land into parcels greater than ten acres where no street right-of-way dedication is involved; (3) widening or opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than two acres into not more than three lots, where no street right of way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication - A gift, by the owner, of his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

D. Reservation - Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

DESIGN STANDARDS

I. Streets and Roads

The design of all roads within Clayton shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the Town of Clayton.

The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

A. Right-of-way Widths - Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

	Minimum ROW
1. Rural	
a. Principal Arterial	
Freeways	350 ft.
Other	200 ft.
b. Minor Arterial	100 ft.
c. Major Collector	100 ft.
d. Minor Collector	80 ft.
e. Local Road	60 ft.[1]
2. Urban	
a. Major Thoroughfare other than Freeway and Expressway	90 ft.
b. Minor Thoroughfare	70 ft.
c. Local Street	60 ft.[1]
d. Cul-de-sac	Variable[2]

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[1] The desirable minimum right-of-way (ROW) is 60 ft. If curb and gutter is provided, 50 feet of ROW is adequate on local residential streets.

[2] The ROW dimension will depend on radius used for vehicular turn-around. Distance from edge of pavement of turn-around to ROW should not be less than distance from edge of pavement to ROW on street approaching turn-around.

The subdivider will only be required to dedicate a maximum of 100 feet of right-of-way. In cases where over 100 feet of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 100 feet. In all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principal and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width right-of-way, not less than sixty feet in width may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is subdivided, the remainder of the full required right-of-way shall be dedicated.

B. Street Widths - Widths for street and road classifications other than local streets shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. Local Residential
   Curb and Gutter section: 26 feet, face to face of curb
   Shoulder section: 20 feet to edge of pavement, 4 foot shoulders

2. Residential Collector
   Curb and Gutter section: 34 feet, face to face of curb
   Shoulder section: 20 feet to edge of pavement, 6 foot shoulders

C. Geometric Characteristics - The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

1. Design Speed - The design speed for a roadway should be a minimum of 5 mph greater than the posted speed limit. The design speeds for subdivision type streets are shown on the following page.

DESIGN SPEEDS			
Facility Type	Design Speed		
	Desirable	Minimum	
		Level	Rolling
Rural			
Minor Collector Roads	60	50	40
Local roads including Residential Collectors and Local Residential	50	50*	40*
Urban			
Major Thoroughfares other than Freeways, Expressways, or Parkways	60	50	50
Minor Thoroughfares	60	50	40
Local Streets	40	40**	30**

2. Maximum and Minimum Grades

   a. The maximum grades in percent shall be:

   b. Minimum grade should not be less than 0.5%.

   c. Grades for 100 feet each way from intersections (measured from edge of pavement) should not exceed 5%.

MAXIMUM VERTICAL GRADE		
Design Speed	Terrain	
	Level	Rolling
60	4	5
50	5	6
40	6	7
30		9

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* Based on projected annual average daily traffic of 400-750. In cases where road will serve a limited area and small number of dwelling units, minimum design speeds can be reduced further.

**Based on projected annual average daily traffic of 50-250.

d. For streets and roads with projected annual average daily traffic less than 250, short grades less than 500 feet long, may be 50% greater than the value in the above table.

3. Minimum Sight Distance - In the interest of public safety, no less than the minimum applicable sight distance shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters. Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1984."

SIGHT DISTANCE				
Design Speed	30	40	50	60
Stopping Sight Distance				
Minimum (ft.)	200	275	400	525
Desirable Minimum (ft.)	200	325	475	650
Minimum K* Value for:				
Crest Curve	30	80	160	310
Sag Curve	40	70	110	160

(General practice calls for vertical curves to be multiples of 50 feet. Calculated lengths shall be rounded up in each case.)

4. The "Superelevation Table" below shows the maximum degree of curve and related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

* K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in feet of the vertical curve which will provide the desired sight distance.

SUPERELEVATION TABLE			
Design Speed	Maximum e*	Minimum Radius ft.	Max. Deg. of Curve
30	0.04	302	19 00′
40	0.04	573	10 00′
50	0.04	955	6 00′
60	0.04	1,528	3 45′
30	0.06	273	21 00′
40	0.06	509	11 15′
50	0.06	849	6 45
60	0.06	1,380	4 15′
30	0.08	252	22 45′
40	0.08	468	12 15′
50	0.08	764	7 30′
60	0.08	1,206	4 45′

e* = rate of roadway superelevation, foot per foot

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees. No street should intersect a railroad at grade at an angle less than sixty-five (65) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Offset intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 200 feet between survey centerlines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than seven hundred (700) feet in length. The distance from the edge of pavement on the vehicular turn-around to the right-of-way line should not be less than the distance from the edge of pavement to right-of-way line on the street approaching the turn-around. Cul-de-

sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street.

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provision is made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least twenty (20) feet.

3. Dead-end alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turn-around facilities at the dead end as may be required by the Planning Board.

G. Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 30 feet from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 6 feet from the face of curb.

I. Wheelchair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

J. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:

   a. Shoulder section approach

      i. Under 800 ADT design year

         Minimum 28 feet width face to face of parapets of rails or pavement width plus 10 feet, whichever is greater.

      ii. 800 - 2000 ADT design year

         Minimum 34 feet width face to face of parapets of rails or pavement width plus 12 feet, whichever is greater.

      iii. Over 2000 ADT design year

         Minimum width of 40 feet, desirable width of 44 feet width face to face of parapets of rails.

   b. Curb and gutter approach

      i. Under 800 ADT design year

         Minimum 24 feet face to face of curbs.

      ii. Over 800 ADT design year

         Width of approach pavement measured face to face of curbs.

         Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet of rail shall be 1'6" minimum, or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

   a. Shoulder section approach - Width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width 8' minimum, 10' desirable.)

   b. Curb and gutter approach - Width of approach pavement measured face to face of curbs.

Clayton
Thoroughfare Plan